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MODEL OPTIMIZE THE PERFORMANCE OF WIRELESS SENSOR NETWORKS FOR OPTIMALITY CAN SELECT FROM TRANSMISSION AND ACTIVITY SCHEDULE ACTIVE/SLEEP SENSOR

The article examines the algorithm increase the lifetime of wireless sensor network. The model performance optimization using a range selection transmission and mode active/sleep sensors.
Keywords: wireless sensor network, optimization, model, range transmission, sensor.

INTRODUCTION

The study and design of wireless sensor networks (WSN) and their characteristics arises the creation of mathematical models to maximize the lifetime of the network, which would solve many complex problems that relate to various applications. One of the main problems in implementing the requirements of quality of service WSN is to provide high fault tolerance, due to violation of the network due to failures of nodes or links. Studies on the power nodes and routing data in recent years shows that energy efficiency is of paramount importance to continue the lifetime of the network [1]. It can be concluded that the mathematical models used to assess not the lifetime of network configurations which vary over time, and maximize their time of trouble.

ANALYSIS OF RECENT RESEARCH

Significant energy savings can be achieved by turning off connectivity node during idle [2, 3, 4]. There are two modes node active/sleep and "active". When the unit is in active mode, it fulfills its obligations when it is in sleep mode, it continues sensing the environment, but does not communicate with other nodes to save energy. However, energy is saved due to potential network bandwidth and improve response time. Niyato Hossain and developed a queuing model to investigate the performance of different expectations and strategies awakening [5]. Chiasserini developed a model to analyze the WSN with a random pattern of sleep, where at some point in time there is a chance that a random node must be active [6].

Maximum one hop transmission distance unit is its transmission range. Chen and Deng determined the optimal transmission range of nodes, thus minimizing the overall network energy costs, and the impact of transmission range shown on the lifetime of WSN using total energy consumption model [7]. It is proved that a large transmission range decreases response time by increasing the power consumption. Gao [8] pointed to a simple linear network (WSN in which sensor nodes are ordered) that the energy consumption can be significantly reduced if the transmission range is updated when the density of nodes varies through lists of active/sleep nodes.

THE WORDING OF THE PURPOSES OF ARTICLE (PROBLEM)

The aim is to develop a model to optimize performance of a wireless sensor network, which will improve the quality of care and life expectancy network.

THE MAIN MATERIAL

The specificity using sensor networks makes it impossible to use standard schemes of wireless networks. Work receiver and transmitter requires major energy expenditure, because these devices have included rare. Usually there is no need to transfer information from one sensor to another, all data must be delivered to the nearest base station. Reliability in transmission is achieved by confirmation of each data packet at each stage of the transfer, not by establishing reliable communication between end nodes in the transmission. Units that are closer to the base station can not simply send the packet on, and aggregate data from the results of their own measurements. Therefore, for sensor networks requires the development of specific effective optimization methods as data and power.

Monitoring Tasks usually do not require transfer of information flows, high density and a reduction in energy consumption of nodes can be achieved, for example, by simultaneous inclusion in a communication on and off for a long time. An important requirement for WSN is the possibility of self-nodes must be able to self-associate to the network and relay data packets to each other, exchange information provided only packets between nodes that are in radio view each other, determined the probability of delivering information packets between nodes. Routes data delivery should be determined dynamically based on the possible failure or breach communications repeaters. These requirements governing wireless communication standard IEEE 802.15.4 [9, 10]. Standard features are low power, short network connection, supporting a large number of customers, the ability to implement the requirements of the standard low-cost devices.

There are several methods to address the problem of maximizing the performance of wireless sensor network. These may include individual selection capacity batteries density units, power transmitters use different routing protocols positioning nodes.

We assume that agents of events passed from node to node using random distribution until or outgoing event (ie reaches its validity) or limited to the lifetime counter. Our model assumes that nodes transmit information to the node randomly selected from a set of nodes within its transmission range. Units can also generate queries to request data or resources on the network. If the request can not locate an informed node to the end of the operation request, the request fails. The overall proportion of generated requests are not serviced on time, ie limiting the refusal of requests is a critical measure of QoS.

In addition, the sensor nodes themselves have a limited life span. If the node does not work through discharge the battery, then we say that node is not served. Otherwise, the node is alive. Living node can be either in sleep (standby) or active. In sleep mode, the node eliminates the possibilities of reading and switching to energy conservation [11]. In densely populated networks subset of nodes placed in standby mode switching session to extend the life of the network. However, network performance can deteriorate when some of the nodes are available for reading and sending agents or event request packet.

Let N - number of nodes in the network. Consider an experiment $\boldsymbol{T}=\{1,2,...,T\}$ ($T<\infty$), where each element **T** is the time between the decision and two decisions - period (eg a week). At the beginning of each node can live or go to standby with probability ($1-p_t$), or stay active with probability p_t. We assume that p_t is the same for all living units.

Consider a model to determine the transmission range (r_t), the lifetime counter events (l_t) and the probability that a node is in active mode p_t for each $t\in\boldsymbol{T}=\{1, 2, ...,T\}$. To construct the model parameter optimization, we introduce the notation:

• A - the set of possible solutions.

$$A=\{(r,l,p): r\in(0,r], l\in \mathrm{N}\setminus\{N\}, p\in(0,1]\},$$

where $r=\sqrt{2L}$ - the maximum distance between two nodes in a square field deployment of

R;

• $a_t \in A$ - a decision taken at the beginning of period t.

$$a_t = (r_t, l_t, p_t) \in A$$

where r_t - range transmission, l_t - counter lifetime events, p_t - of active nodes.

• s_t - the number of nodes that are alive at the beginning of period *t*, $s_t \in N$;

• n_t - expected number of active nodes at the beginning of period *t*;

• c (s_t, a_t) - expected battery life that spent active node during period *t*. We assume that at time *t* the energy cost of all units are independent and uniformly distributed.

• b_t - expected available battery power at the node at the beginning of period *t*. For simplicity, we use the average available energy as a real power available in one node. The active node (in standby mode) does not consume energy with probability 1-p_t. However, in active mode consumes with probability pt. Thus, the expected energy available in period *t+1* is defined recursively $b_{t+1}=b_t-p_t c(s_t,a_t)$;

• $f(s_t, a_t, b_t)$ - the probability that a node is alive at the beginning of period *t* and out of service during this period. We assume that any active node out of service until the end of period *t*, if the energy required during the period exceeds the average energy that exists at the beginning of the period.

• x_t - state of the network at the beginning of period t

$$x_t = \begin{cases} 1, \text{if} \quad \textit{the network functional} \\ 0, \text{otherwise} \end{cases}$$

• Δ(n_t,a_t) refusals of requests at time *t*.

The functioning of the network means that the network is connected and satisfies QoS requirements at the beginning of period t. Limitations of requests that are not serviced on time is critical measure QoS based on the needs of wireless sensor network is determined by considering the limiting behavior of one query in shenerovan uninformed node.

Model optimization

Let φ maximum allowable failure rate request, ξ minimum allowable probability that the network is connected, and $\bar{b}$ initial energy available to the node. Overall, ξ should be close to 1 and φ should be close to 0. We propose the following model to determine the optimal transmission range, the lifetime of the meter and active modes (including those failed) for each crucial period ***T***. We denote this as:

$$\max \sum_{t=1}^{T} x_t \tag{1}$$

$$\Delta(n_t, \alpha_t) \le \varphi + M(1 - x_t), \quad t \in T \tag{2}$$

$$\psi(n_t, \alpha_t) \le \zeta - M(1 - x_t), \quad t \in T \tag{3}$$

$$n_t \le s_t p_t, \quad t \in T \tag{4}$$

$$s_{t+1} \le s_t - f(s_t, \alpha_t, b_t) n_t, \quad t \in T \setminus \{\mathrm{T}\} \tag{5}$$

$$b_{t+1} = b_t - p_t c(s_t, \alpha_t), \quad t \in T \setminus \{\mathrm{T}\} \tag{6}$$

$$x_t \geq x_{t+1}, \quad t \in T \setminus \{\mathrm{T}\} \tag{7}$$

$$\alpha_t = \{r_t, \ell_t, p_t\} \in A, \quad t \in T \tag{8}$$

$$x_t \in \{0,1\},\ b_t \in [0, \bar{b}], \quad t \in T \tag{9}$$

$$s_t \in \{0,1,\ldots,N\},\ n_t \in \{0,\ldots,N\}, \quad t \in T \tag{10}$$

The objective function (1) is the number of consecutive time periods that the network meets the QoS requirements and connections. In constraints (2) and (3), M large positive constant, which makes xt take the value 1 if and only if both performed in period *t* QoS constraints and connection. For completeness, we also include restrictions (4) and (5) to set the number of active and living units. Limitations (6) ensures that the expected energy available in each period is calculated based on energy costs in the previous period of time. Limitation (7) ensures that the network meets the QoS constraint and connect in consecutive periods. Valid ranges of values are given in (8) through (9) and (10). This model is nonlinear with additional restrictions.

CONCLUSIONS AND RECOMMENDATIONS FOR FURTHER RESEARCH

The proposed model improved performance wireless sensor networks by optimizing the lifetime of the entire system to resolve the issue as improving the quality of QoS. The proposed expressions for determining the optimal range data, the lifetime counter and modes of active nodes allow the design phase comparison network topologies to build the most effective and make it possible without expensive field experiments to obtain estimates of the characteristics of wireless sensor network.

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